Claims

1. Apparatus for the removal of a fluid component from particulized solid materials comprising;

- a housing (1)
- a perforated plate (2) separating the housing (1) into two chambers (3) and (4),chamber (3) being a gas introduction chamber and chamber (4) being a reaction/drying chamber, whereby:
- chamber (3) is provided with two separated gas inlets (5) and (6)
- gas inlet (5) being present in the bottom (7) of chamber (3) and providing an axial direction to the gas and
- gas inlet (6) being present below the plate (2) and providing a tangential direction component to the gas
- the perforated plate (2) is provided with an outlet opening (8),provided with a removable plug (9) for opening and closing of outlet opening (8)
- means (10) for feeding the solid particulized material into chamber (4)
- a gas outlet system (17) for the removal of the gases from chamber (4)
- heating means (15,18)for the heating of the gases introduced via gas inlets (5) and (6).

2. Apparatus according to claim 1 wherein the perforated plate (2) is provided with perforations (11) with a diameter between 0.5 and 4 mm.

3. Apparatus according to claims 1 and 2, wherein the total surface of the perforations in plate (2) is 10-30 %, preferably 15-25 % of the total plate surface.

4. Apparatus according to claims 1-3, wherein plate (2) has a shape of a wok, while at the lowest point of the wok outlet opening (8) is present.

5. Apparatus according to claims 1-4, wherein the ratio between thickness (t) of plate (2) and diameter (d) of the perforations (11) in plate (2), i.e. $t/d = 0.2\text{-}1.6$.

6. Apparatus according to claims 1-5, wherein gas inlet (6) is present at a point above 0.4h, preferably at a point above 0.5h from the bottom of housing (1), h being the height of chamber (3).

7. Apparatus according to claims 1-6, wherein a heat sensor (12) is present in chamber (3).

8. Apparatus according to claims 7, wherein in chamber (4) also a heat sensor (13) is present.

9. Apparatus according to claims 7 or 8, wherein heat sensor (12) or heat sensors (12) and (13) are connected with regulating means (14) for regulating the heating of the gasstreams for the inlets (5) and (6).

10. Apparatus according to claims 1-9, wherein gas inlet (6) is provided with means for pulsating the gas stream via inlet (6).

11. Apparatus according to claims 1-10, wherein the plug (9) is attached to a plunger (19), while plug (9) corresponds with the shape and size of outlet opening (8) in plate (2), which outlet opening has a diameter of 100-200 mm.

12. Apparatus according to claims 1-11, wherein in the gas outlet system (17) leaving chamber (4) an indirect heat exchanger (15) is present, whereas the gas in outlet (17) is in indirect heat exchange with the fresh gas (21) introduced in the system via inlets (5) and/or (6).

13. Apparatus according to claims 1-12, wherein in the gas system, leaving heat exchanger (15) a valve (16) is present for dividing the introduction gas over inlets (5) and (6).

14. Process for the removal of a fluid component from particulized solid material in a reactor, wherein the solid particulized material is fluidized by a preheated gas providing to the solid particles an axial velocity component and a preheated gas providing to the solid particles a tangential velocity component in such a way that during the heat treatment the solid particles form a fluidized, annular bed of particles, at a temperature and for a time sufficient to remove the fluid component without overburning of the solid particulized material, whereupon the treated solid particulized material is separated from the reactor as end product, while thereafter fresh solid particulized material, from which the fluid component still must be removed, is introduced in the reactor.

15. Process according to claim 15, wherein the gas providing the tangential velocity component is introduced in the reactor below a perforated plate that forms a barrier between an introduction chamber for the treatment gases and a reaction chamber.

16. Process according to claims 14-15, wherein the gases that provide the axial velocity component and the the tangential component are introduced in the introduction chamber in a ratio $V_{ax} : V_{tang} = 0.1$ to 10, V_{ax} being the velocity of the gas providing the axial component and V_{tang} being the velocity of the gas providing the tangential component.

17. Process according to claims 14-16, wherein the gases are introduced in the reactor with such a velocity that the solid particulized material that is introduced above the perforated plate remains above the perforated plate in the form of an annular fluidized bed of solid particles.

18. Process according to claims 14-17, wherein the temperature of the gases introduced in the reactor ranges between 180 and 350 oC, preferably 200 to 300 oC at a point directly under the perforated plate.

19. Process according to claims 14-18, wherein the temperature of the gases that are introduced in the reactor is controlled by a the signal from a temperature sensor in the introduction chamber of the reactor which signal is fed to an indirect heat exchanger wherein fresh introduction gas is in indirect heat exchange with gas removed from the reactor.

20. Process according to claims 14 - 19, wherein the residence time of the particulized material in the reactor ranges from 15 to 90 sec, in particular from 20 to 60 sec.

21. Process according to claims 14-20, wherein the treatment chamber of the reactor is provided with a plunger provided with a plug, corresponding in size and shape with an opening in the lowest part of the perforated plate, which plunger is lifted after the treatment of a batch of particulized solid material is finished whereupon the treated end product is removed from the reaction chamber, using the overpressure within this chamber.

22. Process according to claims 14-21 wherein the gas providing the tangential velocity component to the solid particles is introduced in the reactor while pulsating with an amplitude of 0.25 to 10 Hertz.

23. Process according to claims 14 - 22 wherein the particulized solid material is a food product, in particular grained rice and the fluid component to be removed herefrom is water.

24. Process according to claims 14 -23 wherein the gas applied is an inert gas, preferably air or nitrogen.